

WHAT IS CLAIMED IS:

1. A metal back-attached phosphor screen, comprising a phosphor layer and a metal back layer on an inner surface of a face plate, wherein a first treatment layer containing an oxide of one kind or two or more kinds of elements selected from the group consisting of silicon, aluminum, titanium, and zirconium is formed on the phosphor layer and the metal back layer is formed on the first treatment layer.
2. The metal back-attached phosphor screen as set forth in claim 1, wherein the oxide in the first treatment layer contains one kind or two or more kinds of alkali metal elements.
3. The metal back-attached phosphor screen as set forth in claim 1, wherein a content (per unit area, hereinafter same as this) of the oxide in the first treatment layer is 2 wt% to 20 wt% of a content of a phosphor in the phosphor layer.
4. The metal back-attached phosphor screen as set forth in claim 1, wherein the first treatment layer contains silicon dioxide ( $\text{SiO}_2$ ), titanium oxide ( $\text{TiO}_2$ ), and zirconium oxide ( $\text{ZrO}_2$ ).
5. The metal back-attached phosphor screen as set forth in claim 4, wherein all following expressions hold when content percentages of respective elements of silicon, titanium, and zirconium in the first treatment layer are expressed as weight percentages and silicon dioxide is  $x_1\%$ , titanium oxide is  $y_1\%$ , and zirconium oxide is  $z_1\%$ .

$$70 \leq x_1 + y_1 < 100$$

$$x_1 + 0.5y_1 \leq 80$$

$$x_1 + y_1 + z_1 = 100$$

(  $x_1 > 0$ ,  $y_1 > 0$ ,  $z_1 > 0$  )

6. The metal back-attached phosphor screen as set forth in claim 1, further comprising a second treatment layer containing an oxide of one kind or two or more kinds of elements selected from the group consisting of silicon, aluminum, titanium, and zirconium on the metal back layer.

7. The metal back-attached phosphor screen as set forth in claim 6, wherein the oxide in the second treatment layer contains one kind or two or more kinds of alkali metal elements.

10 8. The metal back-attached phosphor screen as set forth in claim 6, wherein a content of the oxide in the second treatment layer, as a component weight per unit area of the metal back layer, is  $4 \mu\text{g}/\text{cm}^2$  to  $40 \mu\text{g}/\text{cm}^2$ .

15 9. The metal back-attached phosphor screen as set forth in claim 1, further comprising a second treatment layer containing one kind or two or more kinds of inorganic oxides selected from the group consisting of silicon oxide, a silicon oxide containing one kind or two or more kinds of alkali metal elements, aluminum oxide, titanium oxide, and zirconium oxide on the metal back layer.

20 10. The metal back-attached phosphor screen as set forth in claim 9, wherein a content of the inorganic oxide in the second treatment layer, as a component weight per unit area of the metal back layer, is  $4 \mu\text{g}/\text{cm}^2$  to  $40 \mu\text{g}/\text{cm}^2$ .

25 11. The metal back-attached phosphor screen as set forth in claim 6, wherein the second treatment layer contains silicon dioxide ( $\text{SiO}_2$ ), titanium oxide ( $\text{TiO}_2$ ), and zirconium oxide ( $\text{ZrO}_2$ ).

12. The metal back-attached phosphor screen as set forth in claim 11, wherein all following expressions hold when content

percentages of respective elements of silicon, titanium, and zirconium in the second treatment layer are expressed as weight percentages and silicon dioxide is  $x_2\%$ , titanium oxide is  $y_2\%$ , and zirconium oxide is  $z_2\%$ .

5  $70 \leq x_2 + y_2 < 100$

$$x_2 + 0.5y_2 \leq 80$$

$$x_2 + y_2 + z_2 = 100$$

$$(x_2 > 0, y_2 > 0, z_2 > 0)$$

13. A metal back-attached phosphor screen, comprising a  
10 phosphor layer and a metal back layer on an inner surface of a face plate, wherein a first treatment layer containing one kind or two or more kinds of inorganic oxides selected from the group consisting of silicon oxide, a silicon oxide containing one kind or two or more kinds of alkali metal elements, aluminum oxide, titanium oxide, and  
15 zirconium oxide is formed on the phosphor layer and the metal back layer is formed on the first treatment layer.

14. The metal back-attached phosphor screen as set forth in claim 13, wherein a content of the inorganic oxide in the first treatment layer is 2wt% to 20wt% of a content of a phosphor in the  
20 phosphor layer.

15. The metal back-attached phosphor screen as set forth in claim 13, further comprising a second treatment layer containing an oxide of one kind or two or more kinds of elements selected from the group consisting of silicon, aluminum, titanium, and zirconium  
25 on the metal back layer.

16. The metal back-attached phosphor screen as set forth in claim 15, wherein the oxide in the second treatment layer contains one kind or two or more kinds of alkali metal elements.

17. The metal back-attached phosphor screen as set forth in claim 15, wherein a content of the oxide in the second treatment layer, as a component weight per unit area of the metal back layer, is  $4 \mu\text{g}/\text{cm}^2$  to  $40 \mu\text{g}/\text{cm}^2$ .

5 18. The metal back-attached phosphor screen as set forth in claim 13, further comprising a second treatment layer containing one kind or two or more kinds of inorganic oxides selected from the group consisting of silicon oxide, a silicon oxide containing one kind or two or more kinds of alkali metal elements, aluminum oxide,  
10 titanium oxide, and zirconium oxide on the metal back layer.

19. The metal back-attached phosphor screen as set forth in claim 18, wherein a content of the inorganic oxide in the second treatment layer, as a component weight per unit area of the metal back layer, is  $4 \mu\text{g}/\text{cm}^2$  to  $40 \mu\text{g}/\text{cm}^2$ .

15 20. The metal back-attached phosphor screen as set forth in claim 15, wherein the second treatment layer contains silicon dioxide ( $\text{SiO}_2$ ), titanium oxide ( $\text{TiO}_2$ ), and zirconium oxide ( $\text{ZrO}_2$ ).

21. The metal back-attached phosphor screen as set forth in claim 20, wherein all following expressions hold when content  
20 percentages of respective elements of silicon, titanium, and zirconium in the second treatment layer are expressed as weight percentages and silicon dioxide is  $x_2\%$ , titanium oxide is  $y_2\%$ , and zirconium oxide is  $z_2\%$ .

$$70 \leq x_2 + y_2 < 100$$

25  $x_2 + 0.5y_2 \leq 80$

$$x_2 + y_2 + z_2 = 100$$

$$(x_2 > 0, y_2 > 0, z_2 > 0)$$

22. A method of forming a metal back-attached phosphor screen,

comprising:

forming a phosphor layer on an inner surface of a face plate;

forming a first treatment layer containing an oxide of one  
kind or two or more kinds of elements selected from the group consisting  
5 of silicon, aluminum, titanium, and zirconium on the phosphor layer;  
and

forming a metal back layer on the first treatment layer.

23. The method of forming a metal back-attached phosphor  
screen as set forth in claim 22, wherein the oxide in the first treatment  
10 layer contains one kind or two or more kinds of alkali metal elements.

24. A method of forming a metal back-attached phosphor screen,  
comprising:

forming a phosphor layer on an inner surface of a face plate;

forming a first treatment layer containing one kind or two  
15 or more kinds of inorganic oxides selected from the group consisting  
of silicon oxide, a silicon oxide containing one kind or two or more  
kinds of alkali metal elements, aluminum oxide, titanium oxide, and  
zirconium oxide on the phosphor layer; and

forming a metal back layer on the first treatment layer.

20 25. The method of forming a metal back-attached phosphor  
screen as set forth in claim 24, wherein the forming the first treatment  
layer comprises:

applying/drying a solution containing a component which  
produces the inorganic oxide by heating with water as a main solvent  
25 to form a lower coating film on the phosphor layer;

applying/drying a solution containing a component which  
produces the inorganic oxide by heating with an organic solvent as  
a main solvent to form an upper coating film on the lower coating

film; and

heating a coating film in which the lower coating film and the upper coating film are stacked to form a layer mainly composed of the inorganic oxide.

5           26. The method of forming a metal back-attached phosphor screen as set forth in claim 24, wherein the forming the first treatment layer comprises:

hydrolyzing and polymerizing alkoxide (alcoholate) containing at least one kind of element selected from the group  
10 consisting of silicon (Si), titanium (Ti), and zirconium (Zr) in a solution;

applying/drying a solution containing oligomer obtained in hydrolyzing and polymerizing to form a coating film; and

heating the coating film to form a layer mainly composed of  
15 the inorganic oxide.

27. The method of forming a metal back-attached phosphor screen as set forth in claim 24, further comprising forming a second treatment layer containing one kind or two or more kinds of inorganic oxides selected from the group consisting of silicon oxide, a silicon  
20 oxide containing one kind or two or more kinds of alkali metal elements, aluminum oxide, titanium oxide, and zirconium oxide on the metal back layer.

28. The method of forming a metal back-attached phosphor screen as set forth in claim 27, wherein the forming the second  
25 treatment layer comprises:

hydrolyzing and polymerizing alkoxide (alcoholate) containing at least one kind of element selected from the group consisting of silicon (Si), titanium (Ti), and zirconium (Zr) in

a solution;

applying/drying a solution containing oligomer obtained in hydrolyzing and polymerizing to form a coating film; and

heating the coating film to form a layer mainly composed of  
5 the inorganic oxide.

29. The method of forming a metal back-attached phosphor screen as set forth in claim 27, wherein in forming the second treatment layer, a  $\text{SiO}_x$  layer is formed by a sputtering method while a Si target is thermal sprayed with oxygen introduced.

10 30. An image display device, comprising:

a face plate;

a rear plate disposed facing the face plate;

numerous electron emitting elements formed on the rear plate;

and

15 a phosphor screen formed on the face plate in such a way as to face the rear plate and emitting light by electron beams emitted from the electron emitting elements,

the phosphor screen being a metal back-attached phosphor screen as set forth in any one of claims 1 to 21.